

IV. RIPARIAN HABITATS AND WILDLIFE

The Sacramento River has meandered across the Valley for thousands of years, transforming the landscape and supporting a unique riparian ecosystem within its floodplain. The dynamic riverine processes reviewed in Chapter III have created and maintained this ecosystem. The plants in these riparian communities have adapted to and become dependent upon these natural processes. In turn, many species of fish and wildlife that inhabit the riparian corridor have adapted exclusively to these habitat communities. As a result, threats to the viability and connectivity of this habitat are threats to the viability of those species.

The wildlife and fishery resources of the Sacramento River riparian ecosystem are of great natural and economic importance. The river corridor supports a great variety of resident and migratory species. Waterfowl and songbirds are attracted by the diversity and richness of the riparian habitat. Many neotropical songbirds breed in the riparian communities along the river and winter in Central and South America while other species prosper in the moist and lush environment all year long. The river supports four distinct runs of Chinook salmon, which are the greatest source of supply for the commercial salmon fishery off the California coast. It also supports runs of other anadromous game fish including steelhead trout, striped bass, shad and sturgeon, which combine to generate substantial local economic activity.

This Chapter reviews the adaptation of plants to the dynamic riverine environment and the related adaptations of animals to the resulting habitats. It also identifies key impacts to these habitats that threatened wildlife in the Colusa Subreach. This Chapter also identifies special status species, which are species that are listed as Threatened, Endangered or of Special Concern under state and federal Endangered Species Acts.

This review of the natural environment must, however, be considered in the context of the existing pattern of land uses and the changes that have occurred over the past 150 years. The modification of the river's flow regime and the removal of most of the native vegetation on the floodplain have contributed to the development of an agricultural economy that is the mainstay of the Sacramento Valley and a social fabric that has developed over many generations. Colusa Subreach Planning is intended to develop a strategy for ecosystem improvements that is reasonably integrated with these existing patterns of economic and social activity.

A. Existing Habitat Communities and Plants

The Colusa Subreach is part of a rich riparian ecosystem that supports a wide variety of wildlife and fish on a seasonal and year-round basis. Within this ecosystem, riparian habitat provides the food, water, and shelter necessary for the reproduction and survival of many native and nonnative species of wildlife. The habitat includes various forms of vegetation, wetlands, banks, sand and gravel bars along the river. The *Sacramento River Conservation Area Handbook*, Chapter 2, contains a description of the habitats in the river corridor. Much of the material in this Chapter is adapted from the *Handbook*. Relevant material is also adapted from *Comprehensive Management Plan for the Sacramento River Wildlife Area*, which was prepared by the California Department of Fish and Game in 2003.

Ecological Adaptation – The riparian vegetation along the Sacramento River has evolved in an environment maintained by the natural disturbance regime of the river. This regime is primarily composed of flooding and substrate erosion and deposition. The majority of the species are phreatophytes, which must have their roots in contact with a stable water supply during long periods of the year. Most of the trees within the riparian corridor are broadleaved and deciduous during the winter months. Broad leaves enable trees to maximize sun exposure, thus maximizing growth. Early colonizing species such as willows and cottonwood exhibit rapid growth of foliage and roots, characteristics necessary for surviving during the hot, dry summers on a substrate composed of alluvial sands or gravels with available subsurface water. Other adaptations that plants have made to thrive in the riparian corridor include:

- seed dispersal mechanisms to ensure successful recruitment such as seeds which float and are resistant to rotting
- adventitious roots (roots that bud from buried stems) which form after sediments are deposited over plants during flood events
- ability to tolerate low levels of oxygen in soil in flooding events
- ability to form suckers and roots after mechanical damage

These adaptations help to ensure species survival in the portions of the Subreach that are subject to frequent riverine disturbances. Individual plants may not always survive following disturbances at particular sites, however, the species readily colonize other newly disturbed or deposited areas and the cycle will be repeated.

As silt accumulates under the initial willow-cottonwood scrub, other trees such as box elder and ash are able to germinate in the spring after flooding has ended. Because the existing trees have slowed the flood flows, the materials deposited in these areas tend to have a higher percentage of fine material such as silt. This finer material builds soils that are able to retain moisture longer than sand and gravel substrates and thus additional species can thrive. Species such as box elder and ash can tolerate some deposition, but not to the same extent as the early- colonizing cottonwood and willow species. On higher areas of the floodplain where the disturbance regime is more muted and deposited soils are deeper, species such as valley oak and sycamore are typically dominant.

Flood events can also result in channel cutoffs, which can bring about major physical change in a short period of time. The Boggs Bend area on the east side of the river, approximately two miles south of Princeton, was the site of such a sudden change in the river channel that resulted in a profound impact on the habitat characteristics of the immediate area. A new river channel was formed through an avulsion or channel cutoff that occurred in the early 1930's. This new channel quickly became the active channel, resulting in the creation of an oxbow lake within the former channel area. Such oxbow areas benefit from the adaptations of the native plant species and the river's steady deposition of sediment. Working in tandem, these forces can develop "optimal" riparian habitat for special status species such as the yellow-billed cuckoo, within as few as 12 years (Greco, 1999).

Successional Stages – From a distance, the riparian communities of the Colusa Subreach appear to be a uniform blanket of lush, green growth. A closer view, however, reveals that there are distinct bands of vegetation that are differentiated by plant species composition, forest structure and wildlife usage. These areas of vegetation are, in turn, differentiated by the magnitude in which

they are affected by the disturbance regimes and by their position on the floodplain. The Subreach is located on the river where the natural disturbance regime results in an environment of continual physical change. The riparian communities and their associated vegetation species have adapted to colonize and establish themselves in successional stages as these areas are physically changed over time. Figure 15 illustrates the typical succession pattern for these communities in relation to river hydrology and channel movement.

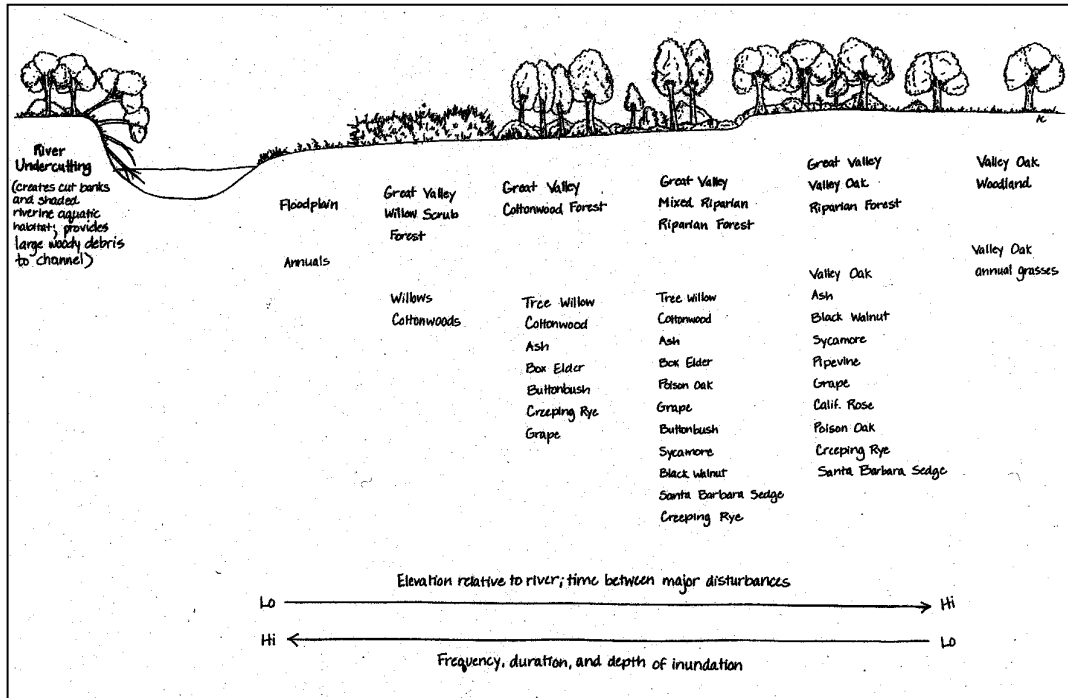


Figure 15. Typical Plant Communities and Successional Stages

Illustration from the Sacramento River Conservation Area Handbook

The successional stages of the riparian communities that occur in the Subreach can be classified into several distinct plant communities for overview purposes. In the field, however, the pattern of riparian communities is far more complex. Any one species of tree, shrub or vine can occur in more than one natural community. There is an intergrading between communities and there is rarely an abrupt edge between them. Figure 15 incorporates a fifth riparian community, the Valley Oak Woodland, which exists in some upland areas outside of the levees. It should be noted that the clearing of riparian forest for other uses, the presence of large project levees and the loss of natural riverine process often interrupts the typical, natural successional pattern reflected on the diagram. The riverine process also creates other aquatic and marsh habitats that are not reflected in this simplified description of typical succession stages.

The California Natural Diversity Database (NDDDB/Holland) classification system was chosen for the primary description of habitat in this Report for consistency with the *Handbook*. This system is also best known by the public in reference to the Subreach. The descriptions of the habitat communities relate to the typical situation and do not reflect variations related to the loss of some natural riverine process in the Subreach. It is important to note that this loss can result in

interference with the typical successional patterns and lead to the grouping of plant species that differ substantially from those listed below.

Great Valley Riparian Forest – The Great Valley Riparian Forest communities, classified by NDDDB/Holland, are the dominant communities in the remaining riparian areas along the river. They are uniquely adapted to the natural processes of the river and the resulting natural environment. Also prominently represented in the Subreach are the Coastal and Valley Freshwater Marsh and the Great Valley Willow Scrub communities. While these communities do not specifically fall within the Great Valley Riparian Forest series in NDDDB/Holland, they are serial stage communities that often succeed to the Great Valley Cottonwood Forest. For the purposes of this Plan, these communities are treated as components of the Great Valley Riparian Forest series.

The Great Valley Riparian Forest communities are a biologically rich habitat. The cottonwood-willow areas support more breeding avian species than any other comparable, broad California habitat type (Gaines, 1977). Riparian forests along the Sacramento River have several characteristics which enable them to support an abundance and diversity of wildlife. Abundant resources, high structure and habitat diversity (maintained over time by flooding and channel movement) and linear continuity all contribute to the diversity of species in the Subreach.

Proximity to water, a variety of soils and periodic influx of nutrient-rich sediment from flooding all contribute to the abundance of resources in the riparian forest system. This abundance continues through the summer months, in contrast with much of California which is hot and dry, such that many plant species outside of the riparian corridor die or go dormant. The riparian forests attract a vast array of terrestrial and aquatic insects, which in turn attract many species of birds, fish and mammals.

- ◆ **Coastal and Valley Freshwater Marsh** occurs commonly in the Subreach on the lowland periphery of the side channels, sloughs and oxbow lakes that are formed by the natural riverine processes. These areas are seasonally inundated to a substantial depth by floodwaters. The plant community is typically dominated by monocots up to two meters in height. These include cattails, bulrush, sedges, spike rushes and watercress. Rooted aquatic species with floating stems and leaves may also be present, including water primrose, water smartweed and pondweed. Black willow and button brush are also common at the edges of the water. The Coastal and Valley Freshwater Marsh areas may succeed to the Great Valley Willow Scrub community, if deposition raises the level of the land above the permanent water level and these areas can rapidly move to the Great Valley Cottonwood Riparian Forest community when deposition rates are substantial. This community is especially important for many species of migratory birds and fish.



Coastal and Valley Freshwater Marsh

- ♦ **Great Valley Willow Scrub** is the most common pioneering community found on depositional areas (typically point bars) on the river's edge. The community will tend to survive along a band that meets the substrate, texture and moisture requirements of germinating seeds. The young plants are adapted to a coarse substrate such as sand or gravel. The rapidly growing root systems must stay in contact with water as it recedes to summer levels. If the right conditions exist, the narrow band of cottonwoods in this community will become the riparian forests of the future. Common species in this community are the sandbar willow, other willow species (black, red, yellow and arroyo willows) and Fremont cottonwood. Openings within the willow scrub may be covered by annual and perennial grasses and forbs. As vegetation slows the velocity of flood flows, deposition increases, reducing the frequency and duration of inundation. As this occurs, California sycamore, box elder and Oregon ash may become established. This community intergrades with and generally succeeds to the Great Valley Cottonwood Riparian Forest.

The initial colonization and long-term survival of these species is directly related to the river's flow regime. If the flow level drops too fast, the roots of young plants cannot reach groundwater levels and the plants die. Research indicates that manipulation of the flow regime on the river can interfere with the colonization of cottonwoods on recently deposited areas (Roberts et al., 2002).

Great Valley Cottonwood Riparian Forest is typically the successor community to the Great Valley Willow Scrub. As the river meanders away frequency of flooding is diminished. This community is dominated by



Great Valley Willow Scrub

Fremont cottonwood, which sometimes constitutes the entire upper canopy. A second tall tree, the black willow, is often a significant member of the community. This community has a total canopy coverage of greater than 80%. Many species are able to germinate under the dense canopy cover, including berries, California rose, wild grape and poison oak, and many smaller tree species. These species combine to develop into a dense understory. Trees such as box elder and ash may become established in the understory, but do not typically become significant canopy species until the land surface is built up and flooding becomes less frequent.



Great Valley Cottonwood Riparian Forest

The tall form of the cottonwood trees is visible from a great distance. It is a common indicator of the river when crossing the featureless areas of the Sacramento Valley. This community intergrades with and generally succeeds to the Great Valley Mixed Riparian Forest away from the river.

Great Valley Mixed Riparian Forest is typically the successor to the Great Valley Cottonwood Forest, as the land area is further raised through deposition of sediment, and flooding frequently continues to diminish. This community has a diverse, often dense, mixture of tall cottonwoods and willows in combination with sycamores, box elders, black walnuts and alders at greater than 80% canopy coverage. Shrubs, such as buttonbrush, blackberries and poison oak, are often covered by an assortment of vines (clematis, wild grape and pipevine) which extend up into the overstory trees. Perennial grasses, such as creeping wild rye and Santa Barbara sedge, may form dense pockets in the understory. Openings in this community may also contain elderberry savanna. This community intergrades with the Great Valley Cottonwood Riparian Forest in lower lying areas and the Great Valley Valley Oak Riparian Forest in higher areas.

This community may be a substantial distance from the active channel, but still experiences relatively frequent flooding. This brings additional deposition, but not necessarily the damaging flows and subsequent erosion. As the community becomes drier (i.e. further above the water table), species such as the valley oaks are able to germinate and become established. Over an extensive period of time, valley oaks become dominant and the community develops into the most mature of the riparian vegetation types, the Great Valley Valley Oak Riparian Forest.

- ♦ **Great Valley Valley Oak Riparian Forest** is dominated by tall, mature valley oaks with significant numbers of sycamores, black walnuts and ash. The canopy is typically less dense than the Great Valley Cottonwood or Mixed Riparian Forest at less than 60% canopy coverage. The understory may be dense, with vines and shrub species typical in the Mixed Riparian Forest, shrub species from drier sites and often stands of perennial grasses and sedges. Often present with this community type are very old specimens of elderberry plants, which are the host of the valley elderberry longhorn beetle.

This community is subject to periodic flooding, but of a lesser frequency and duration than the preceding communities. This brings additional deposition and, as a site rises further above the water table, it can develop into a Valley Oak Woodland. Within the Subreach, inside of the levees, the Valley Oak Woodland does not currently exist.

Habitat Types at the Water's Edge – In addition to creating a mosaic of riparian forest communities, the natural disturbance regime creates other critical habitats and habitat elements. Channel meander, flooding and aggradation create sloughs and side channels, sand and gravel bars, bare cut banks and shaded banks with vegetation and woody debris extending into the water. All of these features and the vegetation that they support play an integral role in the functioning of the riparian ecosystem.

- ♦ **The Open River Channel** is a key part of the riparian ecosystem. The river channel is the migratory route for the annual runs of multiple species of anadromous fish and it sustains the activities of many avian, reptilian,

amphibian and mammalian species. The river channel provides great variation for the species that utilize this habitat. These variations include depth, velocity, cover and riverbed material. Important natural breaks in the consistency of the channel are often formed by vegetative materials that originate in the adjoining river corridor. Large woody debris, often composed of cottonwood or English walnut trees from eroding banks, has been identified as essential components of the habitat that supports fish species including the anadromous species. Concurrently, however, large woody debris has been noted as a concern by local interests who question its impact on boating, infrastructure and the flow capacity of the floodway.

- ♦ **Shaded Riverine Aquatic Habitat** is an important component of the Sacramento River ecosystem that is created as the river erodes into a bank supporting riparian forests. This is where “the adjacent bank is composed of natural, eroding substrate supporting riparian vegetation that overhangs or protrudes into the water” (U.S. Fish and Wildlife Service, 1992). It is characterized by “variable amounts of woody debris, such as leaves, logs, branches and roots, as well as variable depths, velocities and currents.” Shaded riverine habitats with large woody debris provide feeding and cover for aquatic species, such as salmon, and vital nutrients to help maintain the overall health of the ecosystem. They also play an important role in regulating water temperature (Triska and Cromack, 1980).



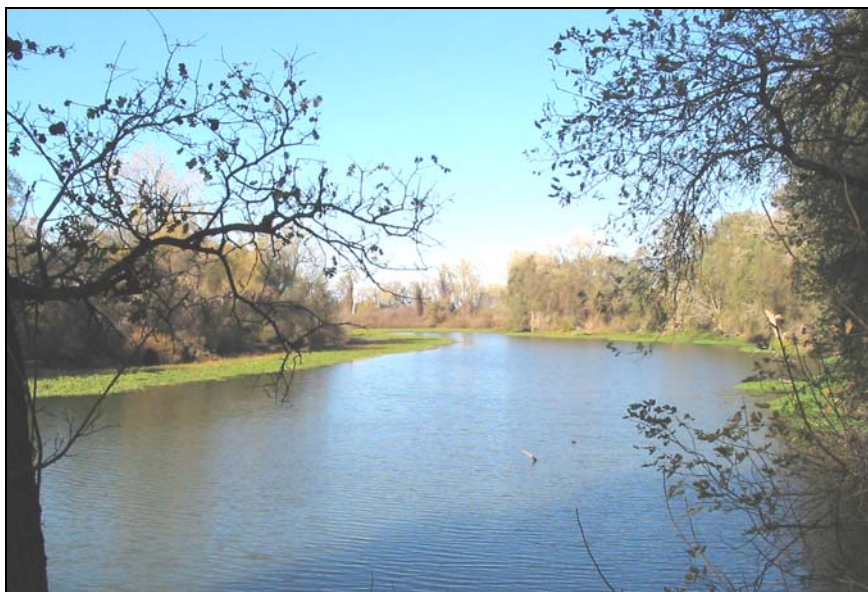
Shaded Riverine Aquatic Habitat

- ♦ **Cut Banks** are another important component of the riparian ecosystem. These nearly vertical banks, substantially free of plant cover, are found on the outside of meander bends where the river is actively eroding high terraces. Cut banks support the majority of California's bank swallow colonies. The bank swallow is a migratory species that winters in Central and South America. It nests in the spring, mostly in freshly eroded earthen banks.

Sloughs, Side Channels and Oxbow Lakes are created by channel movements and contribute substantially to the richness of the riparian ecosystem. They provide shelter from the fast currents of the main channel, creating habitat for many species such as beavers, river otters and northwestern pond turtles. They provide important spawning and rearing areas for fish species, notably chinook salmon, steelhead rainbow trout, and sturgeon and Sacramento splittail (Limm and Marchetti, 2003). Sloughs and side channels often have shaded riverine aquatic habitat along their banks. Most heron rookeries are located in tall vegetation surrounding sloughs oxbow lakes and on mid channel islands.



Cut Bank



Oxbow Lake

B. Existing Wildlife Species

Riparian habitats exhibit great diversity of animal species as compared to many other California terrestrial habitats. Most species are permanent residents, but several species of fish and many avian species are migratory. Overviews of the wildlife and fish populations contained in this section were adapted from the *Comprehensive Conservation Plan for the Sacramento River National Wildlife Refuge* and the *Comprehensive Management Plan for the Sacramento River Wildlife Area*.

Though substantially fragmented, the existing riparian habitat provides an important migration corridor plus an equally important wintering and breeding habitat for migratory birds. The high value of riparian habitats for neotropical migrants has been identified by both the Partners in Flight and the Riparian Habitat Joint Venture programs. Riparian vegetation is also home to a variety of mammals, such as the ringtail, which might not occur in the Sacramento Valley if these habitats were absent.

Riverine and lacustrine (related to the edge of a lake) habitats support a diversity of fish, amphibian, reptilian, avian and mammalian species. The aquatic habitats are especially important to anadromous fish species that utilize these habitats for migratory passage and rearing of young. Riparian vegetation that overhangs the river channel, sloughs and side channels in the Shaded Riverine Aquatic habitat is critically important for salmon.

Mammals – Most mammals (with the exception of bats) are year-round residents of the Subreach. Beaver, muskrat, mink and river otter are found in close proximity to the river channel, sloughs, side channels, oxbow lakes and other wetland areas. Several species of bats are common, including the red bat and Yuma myotis. Upland species in the riparian forests include rodents such as gray squirrel, deer mouse, ground squirrel, rat, shrew, pocket gopher, California vole and porcupine. Other mammals include the mule deer, black-tailed jackrabbit, desert cottontail, spotted and striped skunk, opossum, raccoon, river otter and ringtail. Carnivores include bobcat, the red fox, gray fox and coyote.

Birds - Avian species are a major component of the wildlife resource in the riparian habitat. The Subreach supports a wide variety of permanent resident and migratory species.

- ♦ **Waterfowl** use the wetland habitats of the Subreach primarily for wintering during the months of August through March. Peak wintering populations occur in December to January and a small portion remains through the spring and summer months to nest. Common wintering duck species include northern pintail, wigeon, green-winged teal, gadwall, northern shoveler, wood duck, ring-necked duck, canvasback, redhead and ruddy duck. The most common wintering goose species is the Canada goose. Mallard, cinnamon teal, gadwall, wood duck and lesser numbers of pintail and redhead ducks stay through the spring and summer to nest.
- ♦ **Shore birds** use the Subreach in great numbers during their fall and spring migrations with peak populations in April. Common fall and spring migrants include western and least sandpipers, dunlin, dowitcher, black-necked stilt, American avocet, black-bellied and semi-palmated plovers, greater and lesser yellowlegs, long-billed curlew and whimbrel.

- ♦ **Wading and diving birds** use the Subreach year-round, utilizing wetland and riparian habitats for foraging, roosting and nesting. Species include great blue heron, green heron, black-crowned night heron, great, snowy and cattle egrets, American bittern, white-faced ibis, Virginia rail, sora, moorhen, American coot, pied-billed and western grebes and the double-crested cormorant. Other waterbirds that use the Subreach during various times of the year include western and eared grebe and American white pelican.
- ♦ **Gulls and terns** occupy the Subreach seasonally. Ring-billed and herring gulls are common from the fall into the spring. The Caspian tern is a rare visitor to the river. Forster's terns occur infrequently, but are often seen in small numbers along the river during spring and fall migrations.
- ♦ **Raptors** are a very visible component of the avian population and they are often seen perching along the riparian corridor. Populations are greatest during the winter when the prey base is the greatest. The most abundant wintering species are red-tailed hawk and northern harrier, but bald and golden eagle, white-tailed kite, sharp-shinned hawk, rough-legged hawk, Cooper's hawk, peregrine falcon and short-eared owl occur regularly. The red-shouldered hawk is a resident species and turkey vulture, red-tailed hawk, osprey, bald eagle, white-tailed kite, northern harrier, American kestrel, barn owl and great-horned owl are breeding species. Swainson's hawk is common during the spring and summer when they are nesting in riparian areas.
- ♦ **Game birds** inhabit the Subreach year round. Common species include mourning doves, California quail and ring-necked pheasant. Wild turkey populations are also increasing.
- ♦ **Landbirds** inhabit the Subreach in great diversity and abundance. Both resident and migratory species are found. Common year-round wetland residents include marsh wren, Brewer's blackbird and black phoebe. Resident species that can be found in riparian forests include belted kingfisher, Anna's hummingbird, downy woodpecker, hairy woodpeckers, Nuttall's woodpecker, acorn woodpecker, northern flicker, California towhee, scrub jay, American crow, bushtit, Bewick's wren, mockingbird, loggerhead shrike, starling, western meadowlark and house finch. Additional breeding species supported by these habitats include yellow-billed cuckoo, western wood pewee, ash-throated flycatcher, western kingbird, house wren, American robin, black-headed grosbeaks, titmouse and tree, violet-green, bank, barn and Northern rough-winged swallows, which are found in riparian and adjoining upland areas during the nesting season. Wintering species include ruby-crowned kinglet, yellow-rumped warbler, lark sparrow, golden-crowned sparrow, white-crowned sparrow and lesser and American goldfinches, which may be found in wetland, riparian or upland areas during the winter. Other common migrants include olive-sided flycatcher, horned lark, Wilson's warbler, song sparrow and Lincoln's sparrow.

Reptiles - Common reptile species in riparian areas include the common garter snake, gopher snake, common kingsnake, western fence lizard and alligator lizard. The western rattlesnake also occurs. The northwestern pond turtle and the red-eared slider are found in aquatic and wetland habitats and venture into upland habitats for nesting.

Amphibians - Amphibian species are limited in the Subreach. Common species are the bullfrog, western toad and pacific tree frog.

Fish - Fish are found in the sloughs, side channels and oxbow lakes of the riparian habitat as well as in the channel of the Sacramento River. During periods of high water, species that are normally confined to the river channel occur within the flooded portions of the Subreach. Resident species in these aquatic habitats include hardhead, roach, pike minnow, Sacramento sucker, river lamprey, bluegill, carp, channel catfish, green sunfish, mosquitofish, smallmouth bass and largemouth bass. Anadromous fish include American shad, chinook salmon, striped bass, Sacramento splittail, green and white sturgeon, and steelhead rainbow trout. Four distinct runs of salmon use the river for access to upstream spawning areas, spawning and the rearing of young.

Invertebrates – Invertebrates are found in the greatest abundance and diversity in the aquatic habitats. They provide an important food base for many avian and fish species. Common aquatic invertebrates include waterfleas, snails, clams, dragonflies and damselflies, waterboatmen, backswimmers, beetles, midges, mosquito larva, crayfish and worms. Terrestrial invertebrates such as grasshoppers, beetles, butterflies (including the pipevine swallowtail) moths, midges and ants are an important food base for bats, neotropical migrant birds and waterfowl. The Valley Longhorn Elderberry Beetle nests exclusively within cavities of elderberry plants.

C. Impacts on Habitats and Wildlife

Many changes have occurred along the Sacramento River since the mid 1800's. These changes have resulted in a strong agricultural economy and a reliable water supply for the State of California. At the same time, they have greatly impacted the riparian habitat and the fish and wildlife of the area. Colusa Subreach Planning will not eliminate all these impacts but it is important that they be identified as part of a review of existing conditions. An understanding of these impacts is necessary to help make practical determinations regarding wildlife habitat conservation and restoration in the Colusa Subreach. It is recognized that the clock will not be turned back to the 1800's. Many changes that have taken place along the river have had important positive effects and that the ultimate resolution of these impacts on habitats and wildlife will involve consideration of tradeoffs and diverse opinions.

Loss of Natural Riverine Processes - Natural processes of the Sacramento River have been greatly modified as discussed in Chapter II. The natural processes of erosion, deposition and seasonal flooding historically enriched the riparian areas, creating and sustaining habitat. These changes have substantially interfered with this self-perpetuating system. The regulation of river for water supply, flood control and other purposes has changed the annual flow regime and bank protection has stalled channel meander. As a result, the Sacramento River in the Colusa Subreach has lost some capability to maintain existing habitats and create new areas of habitat.

The regulation of flows for water supply and flood control, which is provided by Shasta Dam, has resulted in many public benefits but it has had a substantial impact on the riparian habitat. The flood flows are reduced in the winter and spring, such that the frequency and duration of inundation are reduced. As a result, the natural distribution of sediment, seeds and other materials that helped to create and maintain habitat is altered. The rate of flow is greatly increased in the summer season and varied in response to water demand, especially those from south of the Delta. This flow regime contradicts the natural regime to which

plants are adapted. This operational control has been found to have negative impacts on the establishment of certain types of riparian vegetation (Roberts et al., 2003). Rapid reduction in flow levels can leave seedlings without adequate moisture so that they cannot continue to survive and become established.

Bank protection can stall the meander function, and with it the creation of habitat. Meander features such as sloughs, side channels and oxbow lakes are not developed, and a comparatively sterile environment can result. The natural variations in channel depth, velocity and vegetative matter are diminished. Areas of shaded riverine aquatic habitat are lost, and the contribution of large woody debris to help sustain the downstream fishery is greatly reduced. These substantial impacts on the wildlife and fishery resources affect both the area where bank protection is applied, and a substantial downstream reach (U.S. Fish and Wildlife Service, 2000).

Habitat Loss and Fragmentation - The substantial reduction and disruption of the riparian habitat has had major negative impacts on the wildlife and fish populations of the Sacramento River riparian corridor. Research indicates that only about 10% of the combined Valley Oak Woodland and Great Valley Riparian Forest in the river corridor, between Colusa and Red Bluff, remains (Golet et al., 2003). In addition, the majority of the associated wetland basins, that are located east and west of the river, have been converted to agricultural and urban uses. The net effect is a huge reduction in the overall area of the habitats that once supported healthy and diverse populations of fish and wildlife.

A serious ramification of this habitat loss along the riparian corridor is habitat fragmentation. Habitat fragmentation occurs when large and contiguous tracts of natural vegetation are converted to other uses, such that only fragments of the original habitat types remain. This fragmentation affects wildlife in various ways that include direct loss of habitat, increased edge effect and isolation effects. The species most affected are those with large home range requirements, species with narrow or very specific habitat needs and species that lack the ability to disperse and adapt. Habitat fragmentation also disrupts migration corridors along the river and connecting tributaries.

Each species requires a specific arrangement of food, water and cover to meet its biological needs. In addition, each species requires a minimum amount of suitable habitat area. For example, the western yellow-billed cuckoo requires dense deciduous forest with dense understory cover near slow-moving water. The species generally selects these habitats for nesting, only if they are in contiguous stands of at least 25 acres in area and at least 300 feet in width (Gaines, 1974). Smaller and narrower sites are seldom used. When species minimum home range sizes are greater than the available fragment sizes, they are frequently eliminated. Therefore, a consequence of habitat fragmentation is a reduction in richness and diversity of species, with the greatest impact being observed in small or linear-shaped fragments.

For area-sensitive species like cuckoos, edge effects further reduce the viability of otherwise suitable habitat areas. Where one habitat type borders another, edge effect can be negative for species that require large blocks of contiguous habitat. The fragmentation of habitat tends to increase the amount of the edge relative to the amount of the interior space. to the adverse impacts of edge effects documented for birds in the riparian forest; include increased nest predation, interspecific competition and reduced pairing and nesting success.

Edge effects have been documented to extend 150 to 1800 feet into the interior of fragmented forest habitats (Paton, 1994).

Isolation effects lessen a species ability to move between fragments of habitat. Isolated fragments may support lower densities of species than similar sized areas of contiguous habitat and that the long-term persistence of species may be lower in these areas. Birds and bats generally have excellent dispersal capabilities, while small mammals and some species of reptiles and amphibians typically have significantly poorer capability to disperse. The habitat in the Colusa Subreach has been substantially reduced in area and greatly fragmented.

Nonnative, Invasive Plant Species - Nonnative, invasive plant species that were not present prior to Euro American settlement have become established in the Colusa Subreach. Some were imported for a variety of purposes that included erosion control, food crops, animal fodder and garden stock and accidental introduction. In some cases, these plants displace or preclude the establishment of native plant communities. They also provide relatively low habitat value for the wildlife species that have adapted to the native species. Some "successful" invasive species feature adaptations, such as the production of large amounts of seeds, fast growth, and the ability to reproduce from small pieces of the plant. Adding to this advantage is the frequent lack of natural herbivores, parasites, diseases and a release from the competitive pressure of plants from their native environment.

An example of such a species is giant reed (*Arundo donax*), a large bamboo-like plant. It is able to reroot from small pieces that are distributed by flood events. It is well adapted to alluvial deposits and often proliferates in the same locations that historically support willow scrub communities. It grows extremely fast (3½ inches per day under optimal conditions) and manual attempts to remove the plant often result in pieces floating downstream to form new stands. It burns easily, but will resprout vigorously after a fire.

Other invasive species such as tree of heaven (*Ailanthus altissima*) appear to "fit" into the riparian environment, but provide poor habitat because they provide less cover value or structure than the native species they replace, or the seeds that they produce are of low nutritional value. Some plants, such as edible fig and black walnut, have the ability to produce chemicals (phytotoxins) that inhibit the germination of competing plant species. Nonnative invasive species, that have particularly serious disruptive impacts to the riparian habitat, include:

<i>Ailanthus altissima</i>	tree of heaven
<i>Apocynaceae</i>	vinca major and minor
<i>Arundo donax</i>	giant reed
<i>Centaurea solstitialis</i>	yellow starthistle
<i>Cynodon dactylon</i>	Bermuda grass
<i>Ficus carica</i>	edible fig
<i>Juglans spp.</i>	black walnut
<i>Rubus discolor</i>	Himalayan blackberry
<i>Sorghum halepense</i>	Johnson grass
<i>Tamarix chinensis</i>	salt cedar
<i>Lepidium latifolium</i>	perennial pepperweed

Some areas along the river, especially on higher elevation locations where flooding is now less frequent, have become dominated by nonnative invasive species such as Johnson grass and yellow starthistle. These exotic communities are acting to preclude the establishment of natural riparian

vegetation, such that, in some cases, the natural succession process of habitat communities has been effectively stalled. The Comprehensive Management Plan for the Sacramento River Wildlife Area documented this situation at the Merrill's Landing, Dicus Slough and Wilson Landing Units (California Department of Fish and Game, 2004). These three sites are located outside of the Colusa Subreach but they are examples of the situation that exists in the Subreach and throughout the Sacramento River Conservation Area.

Fire – The potential for wildfires to substantially impact the riparian habitat is a possible, serious threat to the both the habitat and the related fish and wildlife species. Research has suggested that the lack of a natural flooding regime, that formerly washed out vegetative materials from the riparian areas, can result in increased fire fuel. This greater fuel load might then support more intense fires, which could impact the composition and structure of habitat communities (Ellis 2001). Given the existing impairment of the natural riverine processes, that historically created and renewed riparian habitat, the concern has been raised that future fires could severely damage natural riparian vegetation that lack the natural means of regeneration. This situation could be worsened, if nonnative species invade and proliferate in riparian areas following a fire.

The magnitude of this additional threat is not known. It is known that fire has impacted riparian habitat in the past, although some impacts have been considered positive, and some plants are adapted to respond positively to fire events. The riparian forest is a relatively moist environment compared to upland habitats. Further monitoring and research is required to determine if the threat from wildfire is substantial. Recent habitat management plans, prepared by the Department of Fish and Game and the US Fish and Wildlife Service, recommend a fire protection strategy should be kept current for the protection of both the habitat resource and the adjoining property.

D. Special-Status Species

The Impacts noted in Section C of this Chapter, in conjunction with other wide-scale environmental changes, have resulted in a substantial decrease in the abundance and diversity of wildlife species in the Colusa Subreach and along the entire Sacramento River. Table 4 lists 43 special status species known or thought to occur in the Subreach, their state and federal listing status and a description of the habitat that they utilize. Also included are five plants that are listed as "rare, threatened and endangered" by the California Native Plant Society.

Adaptation to the riparian habitat has occurred over an extended period of time and each of the species in the Subreach depends on different habitat types and components of the riparian ecosystem. As the habitat area has been reduced, fragmented and degraded, some species have been extirpated and others are in danger of being extirpated (no longer existing in the area) State or becoming extinct (no longer existing in the state or country). The least Bell's vireo was considered the most numerous songbird along the river in the 1940's, but it was completely absent by the early 1960's. The vireo depended upon the willow scrub riparian community created by river meander. It is thought that the willow scrub habitat declined, following flood control projects, increasing the vireo's vulnerability to cowbird parasitism which eventually caused its elimination (Frauzreb, 1990).

The bank swallow is another example of a species that depends entirely upon a specific habitat situation created by the dynamics of the river processes. The bank swallows make their nests in the eroding cut banks, which result from the

Table 4. Special-Status Species Known or with Potential to occur in the Colusa Subreach

Species	Status			Habitat
	CNPS	State	Federal	
Fish				
Chinook salmon, Cen Val Sp.-run <i>Oncorhynchus tshawytscha</i>	-	ST	FT	Sacramento River and its tributaries for spawning and rearing
Chinook salmon, Sac River W-run <i>Oncorhynchus tshawytscha</i>	-	SE	FE	Sacramento River and its tributaries for spawning and rearing
Chinook salmon, Cen Val F/late F-run <i>Oncorhynchus tshawytscha</i>	-	SC (2)	FC	Sacramento River and its tributaries for spawning and rearing
Central Valley steelhead <i>Oncorhynchus mykiss</i>	-	-	FT	Sacramento River and its tributaries for spawning and rearing
Green sturgeon <i>Acipenser</i>	-	SC (1)	FC	Sacramento River for spawning and rearing
Hardhead <i>Mylopharadon conocephalus</i>	-	SC (3)	-	Sacramento River and its tributaries for spawning and rearing
River lamprey <i>Lampreta ayresi</i>	-	SC (3)	-	Sacramento River and its tributaries for spawning and rearing
Sacramento perch <i>Archoplites interruptus</i>	-	SC (2)	-	Sacramento River and its tributaries for spawning and rearing
Sacramento splittail <i>Pogonichthys macrolepidotus</i>	-	SC (1)	-	Shallow backwater areas for foraging and rearing
Wildlife				
Valley elderberry longhorn beetle <i>Desmocerus californicus dimorphus</i>	-	-	FT	Elderberries are the sole host plant for nesting
Giant garter snake <i>Thamnophis gigas</i>	-	ST	FT	Backwater areas and marshes with suitable prey, high ground for protection from floods
Northwestern pond turtle <i>Clemmys marmoratta marmoratta</i>	-	SC (2)	FC	Backwater areas and oxbow lakes with aquatic vegetation
Least bittern <i>Ixobrychus exilis</i>	-	SC (3)	FC	Marshes along ponds with tules, cattails and rushes
Bald eagle <i>Haliaeetus leucecephalus</i>	-	SFP	FT	Tall trees for nesting, protected sites with abundant populations of fish
Golden eagle <i>Aquila chrysaetos</i>	-	SC (3)	PR SFP	Tall trees and protected sites with plentiful small/medium -sized mammals for prey
Osprey Pabdion haliaetus	-	SC (2)	-	Tall trees for nesting, protected sites with abundant populations of fish
Northern harrier Circus cyaneus	-	SC (2)	-	Grasslands, meadows and marshes providing tall cover
Cooper's Hawk <i>Accipiter cooperii</i>	-	SC (2)	-	Nests in riparian forests and forages in open woodlands
American Peregrine Falcon <i>Falco peregrinus anatum</i>		SFP		Forages along rivers and wetlands
Merlin <i>Falco columbarius</i>	-	SC (1)	-	Forages along open grasslands, savannas and woodlands
Sharp-shinned hawk <i>Accipiter striatus</i>	-	SC (3)	-	Dense forest and riparian habitats
Swainson's hawk <i>Buteo swainsoni</i>	-	ST	-	Tall trees for nesting and near by open areas for foraging
Short-eared owl <i>Asio flammeus</i>	-	SC (2)	-	Freshwater marsh, lowland meadows with dense tules or grass for nesting and roosts

Species	Status			Habitat
	CNPS	State	Federal	
Long-eared owl <i>Asio otus</i>	-	SC (2)	-	Dense stands of cottonwoods and willows with adjacent open areas for foraging
American white pelican <i>Pelecanus erythrorhynchos</i>	-	SC (1)	-	Sloughs and side channels with a prey base of small fish and amphibians
Double-crested cormorant <i>Phalacrocorax auritus</i>	-	SC (2)	-	Open water for foraging, nests in riparian forest or protected islands
Western yellow-billed cuckoo <i>Coccyzus americanus occidentalis</i>	-	SE	FC	Dense riparian forests with a thick understory of willows for nesting and cottonwood overstory for foraging
Willow flycatcher <i>Empidonax traillii</i>	-	SE	FC	Riparian areas with abundant willows for breeding
Bank swallow <i>Riparia riparia</i>	-	ST	-	Cut banks with sandy or sandy loam soil for nesting
Loggerhead shrike <i>Lanius ludovicianus</i>	-	SC (na)	FC	Open habitats with scattered shrubs, trees and other perches
Yellow warbler <i>Dendroica petechia bewersterii</i>	-	SC (2)	-	Riparian areas with willows, cottonwoods, sycamores or alders for nesting
Yellow-breasted chat <i>Icteria virens</i>	-	SC (2)	-	Riparian areas dominated by willows, alders, Oregon ash, tall weeds blackberry and grape for nesting
Tricolored blackbird <i>Agelaius tricolor</i>	-	SC (na)	-	Nests in dense colonies in emergent marsh vegetation, nesting habitat must be Large enough to support 50 pairs
Fringed Myotis <i>Myotis thysanodes</i>	-	SC	FC	Habitat includes riparian forests
Long-eared Myotis <i>Myotis evotis</i>	-	-	FC	Forages in heavily vegetated habitats
Long-legged Myotis <i>Myotis volans</i>	-	SC	FC	Habitat includes riparian forests
Pallid bat <i>Antrozous pallidus</i>	-	SC	-	Habitat includes riparian forests and oak savanna
Western red bat <i>Lasiurus blossevilli</i>	-	SC	-	Roosts under overhanging leaves of large trees in forest interiors, forages in open air
Small-fotted Myotis <i>Myotis ciliolabrum</i>	-	-	FC	Habitat includes riparian forests
Townsend's big-eared bat <i>Corynorhinus townsendii pallescens</i>	-	SC (2)	FC	Forages along edges of riparian habitats, ,
Western mastiff bat <i>Eumops perotis</i>	-	SC	FC	Forages over open meadows, grasslands, forests and open water.
Yuma Myotis <i>Myotis yumanensis</i>	-	-	FC	Riparian habitats, feeds over water and roosts in cavities in trees
Ringtail <i>Bassariscus astutus</i>	-	SFP	-	Riparian forest habitats
Plants				
Columbian watermeal <i>Wolffia brasiliensis</i>	CNPS 2	-	-	Marsh habitats
Four-angled spikerush <i>Eleocharis quadrangulata</i>	CNPS 2	-	-	Marsh habitats
Fox sedge <i>Carex vulpinoidea</i>	CNPS 2	-	-	Marsh and riparian habitats

Species	Status			Habitat
	CNPS	State	Federal	
Rose mallow <i>Hibiscus lasiocarpus</i>	CNPS 2	-	-	Wet banks, marshes and riparian habitats
Wright's trichocoronis <i>Trichocoronis wrightii</i>	CNPS 2	-	-	Marsh and riparian habitats

Status Key

California

SE	State-listed, Endangered
ST	State-listed, Threatened
SC	State Species of Special Concern
SFP	State Fully Protected

Federal

FE	Federally-listed, Endangered
FT	Federally-listed, Threatened
FC	Federal Species of Concern
PR	Protected under Golden Eagle Protection Act

California Native Plant Society

CSP 1	Plants rare, threatened, or endangered in California and elsewhere
CSP 2	Plants rare, threatened, or endangered in California but more common elsewhere

Sources: US Fish and Wildlife Service, California Department of Fish and Game, California Native Plant Society, PRBO Conservation Science

meandering of the river channel and the river corridor has the greatest concentration of bank swallows in California. Unfortunately, this habitat is the location where landowners and governmental agencies have installed bank protection to prevent river meander. The placing of riprap on cut banks eliminates these vital nesting sites, and this once common species has disappeared throughout much of its historic range (Schlorff, 1977). The Colusa Subreach contains multiple sites where remaining cut banks support nesting populations of bank swallows.

Federally-listed species include species that are listed as “Endangered” and “Threatened” pursuant to the federal Endangered Species Act, as well as species that are fully protected under federal law. Federal “Species of Concern”, as identified by the USFWS, are also noted. State-listed species likewise include species that are listed as “Endangered” and “Threatened” pursuant to the California Endangered Species Act, as well as species that are fully protected under state law. Also included are “Species of Special Concern” as determined by the Department of Fish and Game. These are species that are not state listed as Endangered or Threatened but, nonetheless, are either declining at a rate that could result in listing, or historically occurred in low numbers and known threats to their persistence currently exist.

Table 4 incorporates the special-status species listings, as of this point in time. It is expected that these listings will change over time as new species are listed and others are delisted as the result of successful conservation efforts. Consistent with the policies of CALFED and the SRCAF, Colusa Subreach Planning will address the recovery of special-status species, and the support of other native and game species through an ecosystem approach to habitat management.